RAPID TARGETING AND REAL-TIME RESPONSE:
The Critical Links for Effective Use of Combined Intelligence Products in Combat Operations

Danny Searle
Rick Kirchner
Ted Fincher
Frank Armogida
Naval Air Warfare Center Weapons Division (NAWCWPNS)
China Lake, CA 93555-6100
United States

SUMMARY

A variety of advanced technology projects have demonstrated the key components required to provide rapid targeting for a real-time response. Forward Hunter (led by NAWCWPNS) and Goldpan (led by the Air Force's Aeronautical Systems Center) are examples of Real-Time Information into the Cockpit/Offboard Targeting (RTIC/OT) demonstrations. These programs have shown the value of providing real-time mission updates (based on national offboard signals and imagery intelligence) to shooters pursuing time-critical targets. All these programs employed national exploitation systems and source material products to show that RTIC/OT can increase mission effectiveness, enhance survivability, and increase operational flexibility against time-critical fixed and mobile targets. Each demonstration has focused on different aspects of critical offboard targeting technologies, such as multisource national/ theater intelligence fusion, rapid targeting, near-real-time mission replanning, data dissemination, and onboard processing.

ACRONYMS

ACC	Air Combat Command
ACI	Advanced Capabilites Initiative
AN/AWW-13	U.S. Navy advanced data-link (ADL) pod
AN/AXQ-14	USAF data-link pod
AOC	Air Operations Center
ASARS	advanced synthetic aperture radar system
ASC	Aeronautical Systems Center
ATIMS	Airborne Tactical Information Management System
ATO	air tasking order
CVIC	CV (aircraft carrier) Intelligence Center
DBS	Direct Broadcast Service
ESAI	expanded situational awareness insertion
EUCOM	U.S. European Command
GBU-15	modular guided glide bomb family
GPS	global positioning system
IMINT	imagery intelligence
JDAM	joint direct attact munition
JSOW	joint standoff weapon
JSTARS	Joint Surveillance Target Attact Radar System
JTIDS	Joint Tactical Information Distribution System
JWID	Joint Warrior Interoperability Demonstration
MINT	multisource intelligence
MISST	Mobile Intelligence Strike Support Team (NAWCWSPNS)
MNS	Mission Need Statement
NAVAIR	Naval Air Systems Command
NAWCWPNS	Naval Air Warfare Center Weapons Division
NIS	national input segment (JSIPS)
NRL	Naval Research Laboratory
NSAWC	Naval Strike and Air Warfare Center
OBTEX	offboard targeting experiments
ONR	Office of Naval Research
RITA	rapid imagery transmission to aircraft
RJ	rivet joint
RTIC/OT	real-time information to the cockpit/ offboard targeting
RTR	real-time retargeting
RTT	real-time tasking
SAR	synthetic aperture radar (generic)
SATCOM	satellite communications
SIGINT	signals intelligence
STS	sensor-to-shooter
SWC	Space Warfare Center
TAMPS	Tactical Aircraft Mission Planning System
TARPS	Tactical Air Reconnaissance Pod System (F-14)
TBM	theater ballistic missile
TENCAP	tactical exploitation of national capabilities
TLAM	Tomahawk Land Attack Missile (BGM-109)
TMD-HG	theater missile defense - high gear
TRAP	tactical related applications broadcast
UAV	unmanned air vehicle

OBJECTIVE

While the goal of this paper is to present an historical perspective of RTIC/OT technologies, NAWCWPNS primary focus is to facilitate the transition of RTIC/OT technologies and converge toward

- Establishing a near-term RTIC/OT concept of operations (CONOPS) based on existing systems and technologies and developing a migration path to systems and advanced capabilities slated to be available within a 2005 to 2010 time frame.
- Refining operational prototypes used in ongoing RTIC/OT demonstrations.
- Preparing near-term, mid-term, and long-term technology transition and deployment plans focused on Navy operations and joint service participation.

PROBLEM

What are the warfighters' needs? Precision attack of fixed and rapidly relocatable targets with brief attack windows (e.g., Scud missile launchers in Iraq, camouflaged tanks and artillery in Bosnia, and antiship surface-to-surface cruise missile (SSCM) launchers in the case of amphibious missions) is one of the primary areas in which improved capabilities are needed. National and theater intelligence assets, especially imagery-capable systems, must now detect and localize the target and threats for aircraft in a more timely manner to address the dynamic battlefield (Fig 1).

Current tactical strike aircraft weapon inventories and rules of engagement dictate that the weapon platform make a direct attack and acquire the target with a high-resolution sensor at close range. For the aircraft to survive in a hostile threat environment, minimal exposure time—"one pass, one kill"—and situation awareness (i.e., where are the

nearby threats?) are the keys to survival. Currently, accurate target coordinates and funnel navigation imagery (Fig 2) meet the needs of man-in-the-loop attacks with the present weapon inventory (primarily, laser-guided bombs). Future global positioning system (GPS) or seeker-based bomb-on-coordinate standoff precision-guided weapons (IOC beyond the year 2000) will require more accurate target coordinates and drive advances in digital data links and onboard data processing.

Examination of the Navy's littoral strike mission and the Marine Corps' Operational Maneuver From the Sea reveals that the carrier and amphibious assault ships responsible for providing targeting and command/control are not outfitted with the intelligence feeds, exploitation systems, communications links, and theater battle management (TBM) capabilities required for RTIC/OT. The same is true for Air Force Close Air Support, Deep Strike, and Global Reach capabilities.

Furthermore, Fleet involvement in establishing the operational flow from sensor-to-shooter (STS) and in developing tactics is essential to field an operational RTIC/OT capability. Gaining an operational understanding of national intelligence capabilities is a fundamental skill required to produce effective products in time-critical combat situations.

OPERATIONAL CONCEPT

Fig 3 illustrates our advanced RTIC/OT operational concept for deployed sea-based applications. Our concept is focused on the capability to reduce mission planning time, as well as process RTIC/OT updates during the mission execution phase in response to dynamic battlefield conditions. This concept was derived from our baseline architecture used to support current demonstrations and exercises, and is accomplished by using common electronic digital target folders and exploitation tools across the system. Use of the following key elements are shown in Fig 4.

•**Multisource Feeds.** Real-time receipt of national signals intelligence (SIGINT) data (e.g., TRAP), as well as the capability to request collection of or access to existing archive imagery intelligence databases via a National Input Segment or Custom Product network (i.e., NIS, CPNet reachback). This access includes the capability to import theater-level multisource intelligence data (e.g., U-2, JSTARS, RJ, UAVs) and rapidly fuse with national products

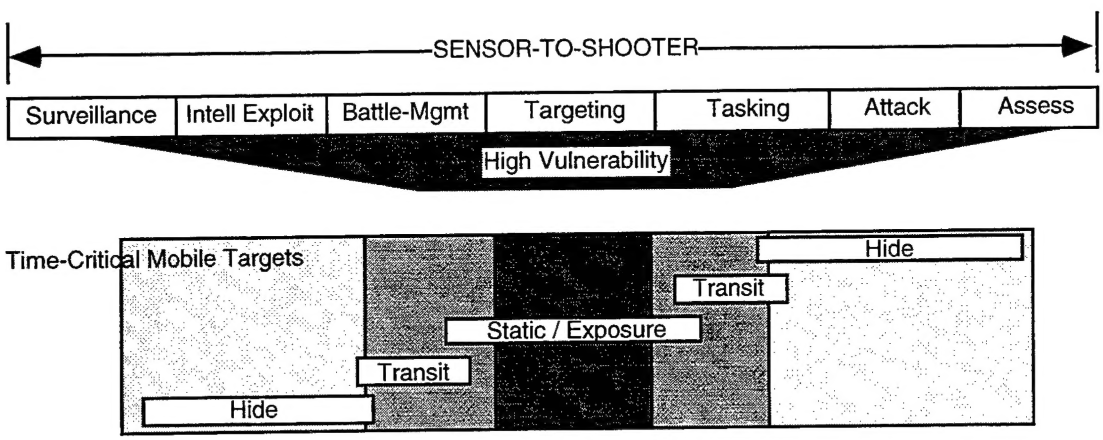

Fig 1. Time-Critical Challenge.

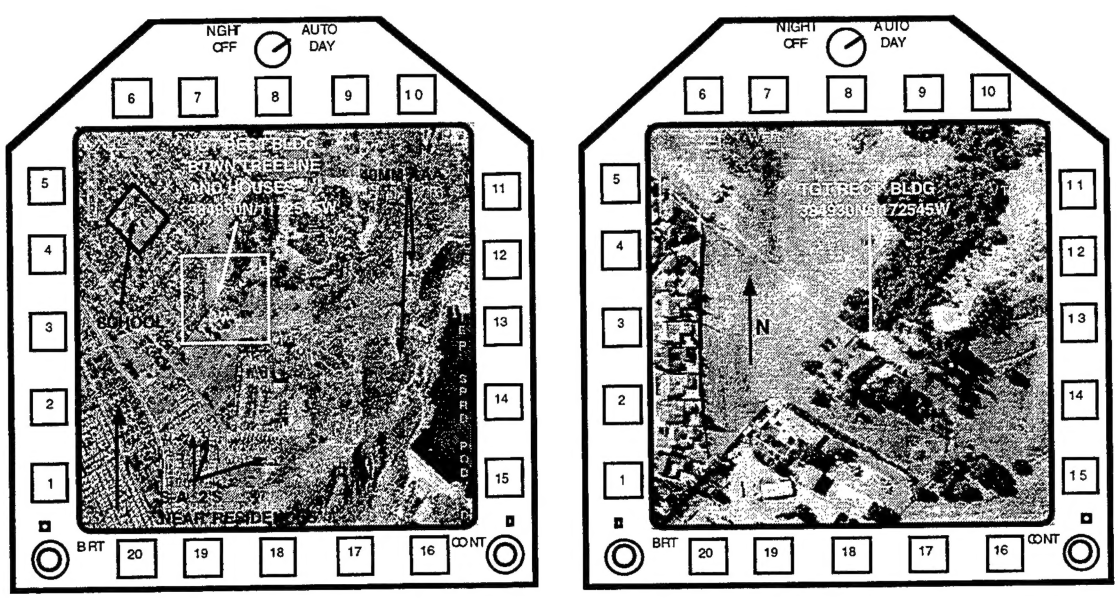

Fig 2. Funnel Navigation.

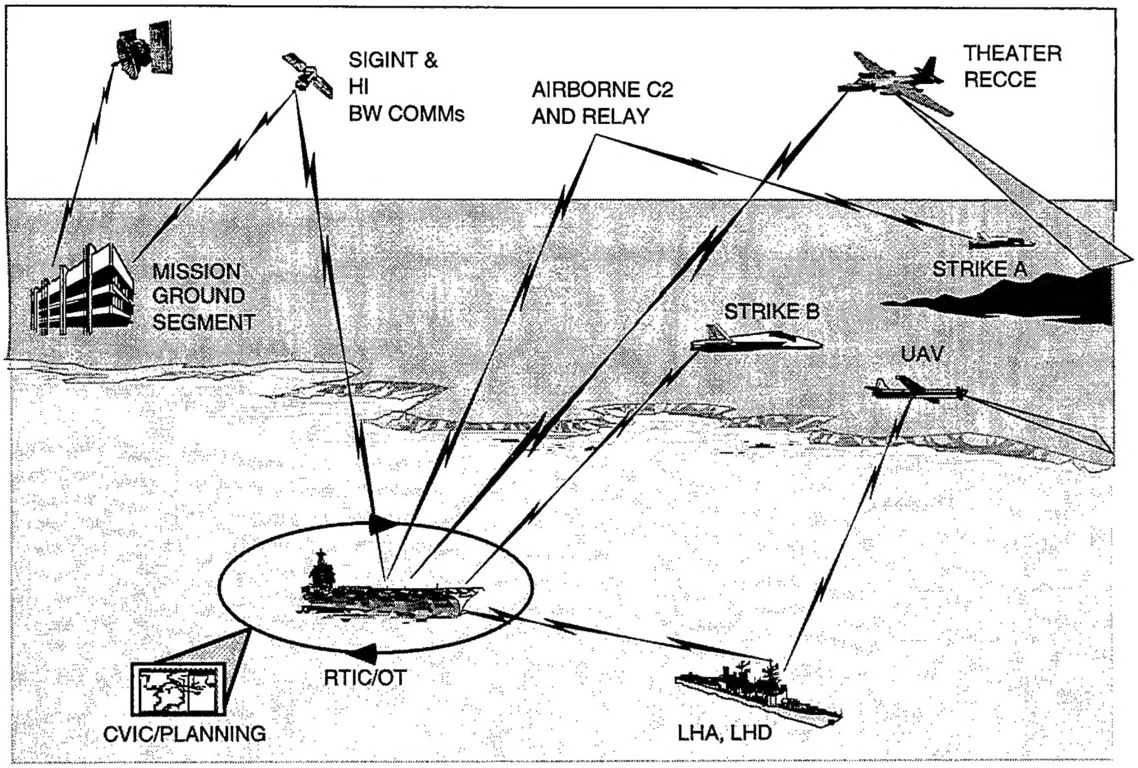

Fig 3. Operational Concept.

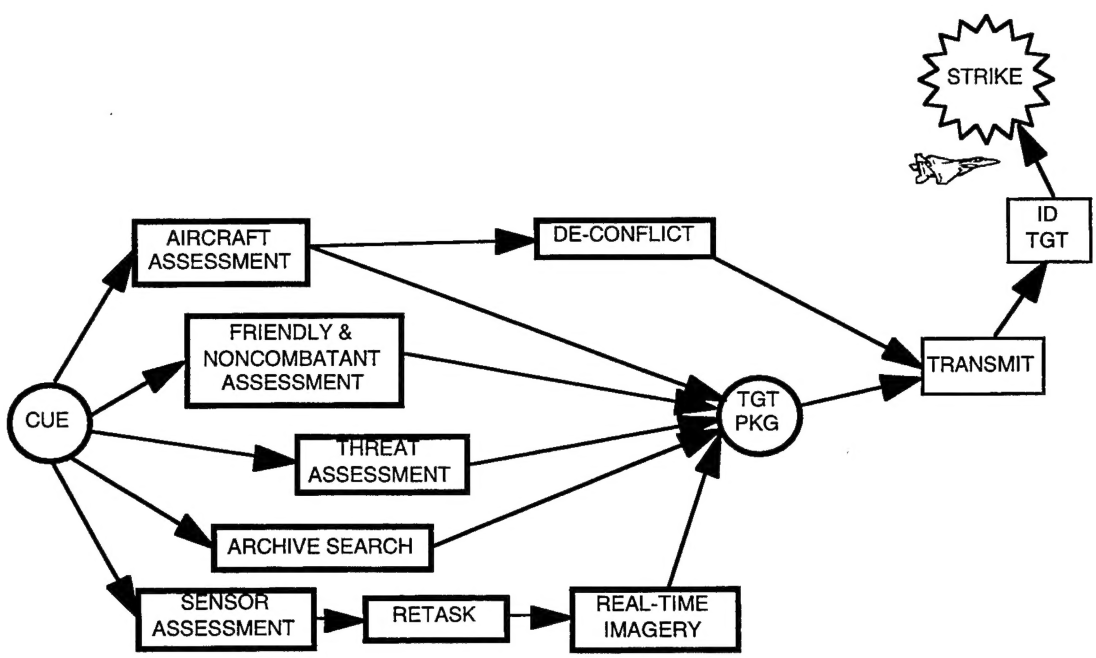

Fig 4. Rapid Targeting Interactions.

to improve accuracy, improve situation awareness, and provide the backbone for rapid targeting and RTIC product generation.

•**Theater Battle Management.** Strike- and unit-level planning TBM systems to generate ATOs and preplan missions, as well as coordinate and avoid conflicts between aircraft retasked in near-real-time as part of RTIC/OT operations. Central to our concept is a RTIC or rapid-targeting cell connected to a Carrier Combat Information Center to address RTIC/OT-specific operations, including the coordination of multisource tasking, intelligence feeds, real-time tasking (RTT), and the production and dissemination of RTIC materials.

•**Command and Control.** Shipboard tracking and communication systems, coupled to the command elements necessary to govern the overall battlespace and ensure that retasked RTIC sorties operate without conflict and with adequate priority within the overall strike plan.

•Communications. Composed of intelligence and mission planning local-area and wide-area networks, as well as line-of-site and beyond-line-of-site video and digital data links to weapon systems to support the data transfer of RTIC/OT products.

•Shooters. Key weapon systems and onboard processing equipment to receive and process RTIC/OT products, including joint-service strike aircraft (e.g., F/A-18, F-15E), associated precision guided weapons (e.g., JDAM), long-range standoff weapon systems (e.g., JSOW, TLAM), as well as Marine-oriented weapon systems.

TECHNOLOGY BASE

As mentioned, a primary emphasis of our approach is to leverage and compliment past and current RTIC/OT-related projects without duplication of effort and make maximum use of previously developed hardware and software (Fig 5). Related R&D projects conducting core technology development include the following.

•STS. A key National Technical Means-sponsored STS core activity to provide overall RTIC technology demonstration support, application of National Technical Means, and prototype multisource intelligence (MINT) exploitation capabilities. These capabilities include rapid data archive retrieval, national-tactical imagery and SIGINT data fusion, targeting materials geopositioning, and tactical data dissemination.

•Arid Hunter. A collaborative NAWCWPNS and NSAWC project to enhance the effectiveness of naval strike aircraft against rapidly relocatable targets. A byproduct of Arid Hunter and the Air Force's RTT program was the foundation of the Mobile Intelligence Strike Support Team (MISST) concept that provides a flexible, low-cost, deployable RTIC cell capability. The MISST concept is designed to support distributed personnel and equipment setup at designated facilities (i.e., AOC) or in a stand-alone capacity via collocation and integration in a commercial deployable van.

•RTT. An Air Force Wright Laboratory (WL/AART)-led RTT concept development program to evaluate on/offboard concepts for adaptive (offensive) mission management to improve air-to-ground deep-strike operations.

•OBTEX. An Air Force Wright Laboratory (WL/AAZT)-led series of offboard targeting experiments (OBTEX) to develop and demonstrate the feasibility to derive target area situation information, SAR-driven precision target coordinates, SAR seeker templates; and program a precision-guided munition in near-real time from offboard resources. This capability includes data transfer to a tactical strike aircraft via line-of-site and satellite communications using Link-16 protocols.

•ATIMS. The NAVAIR-led ATIMS program is leveraging modular processing, advanced display, and virtual reality technology to demonstrate a capability that provides enhanced awareness of engagement parameters, alternative mission selection, and more responsive unit-level mission planning and rehearsal. The current program is focused on demonstrating a mission management device on an F/A-18 testbed.

CAPABILITY DEMONSTRATIONS

A key tactical demonstration (Fig 6) and evaluation that has carried the burden of proof for RTIC/OT effectiveness was the Navy-led Arid Hunter series.

•Arid Hunter Phases I & II. In the spring of 1994, NAWCWPNS China Lake and the Naval Strike and Air Warfare Center, Fallon, Nev., collaborated on Arid Hunter, a project designed to enhance the effectiveness of naval strike aircraft against rapidly relocatable targets. The staff at Fallon felt that the effectiveness would be increased if the latest intelligence information were available to the strike group throughout the entire mission. The current practice of prebriefing a mission provides the strike group with information that is, at best, hours old by the time the aircraft enter the target area. More than 100 Navy and Air Force aircraft participated in the two Arid Hunter exercises at Fallon from March through May of 1994 (Fig 7).

The purpose of Arid Hunter I was to determine if in-cockpit imagery would be useful in aiding the strike process. Because tactical data links, such as Links-4, -11, and -16, currently can transfer little more than tracking information, China Lake provided an image-processing ground station and transmitter (dubbed the Rapid Imagery Transmission to Aircraft (RITA) system), which was compatible with the Navy's AN/AWW-9 and -13 weapon-wide data-link pods and the Air Force's AN/AXQ-14 system. RF-4 and F-14 Tactical Air Reconnaissance Pod Systems (TARPS) imagery was analyzed in a simulated CVIC and transmitted to aircraft carrying data-link pods. A control group of similar aircraft attempted to find the target using a

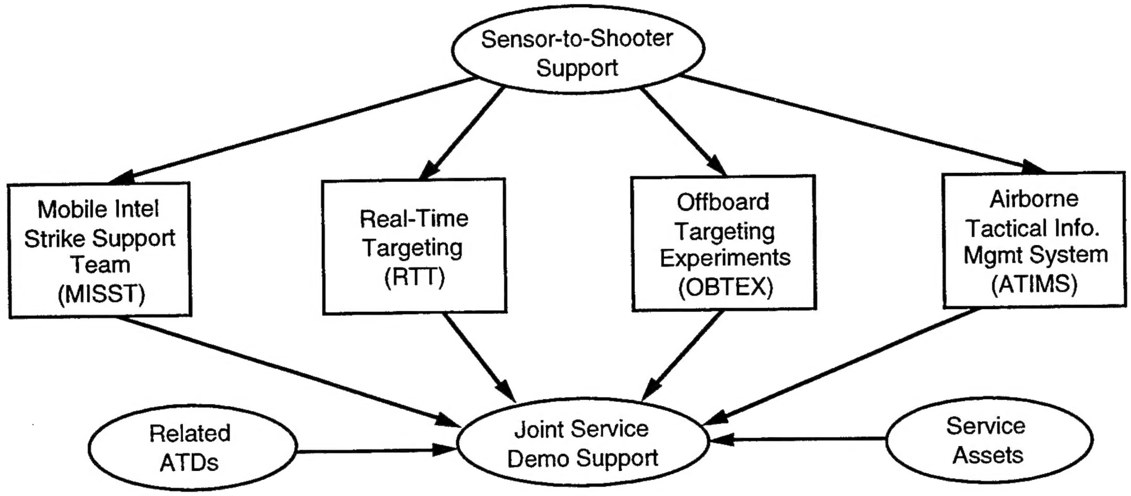

Fig 5. Technology Base.

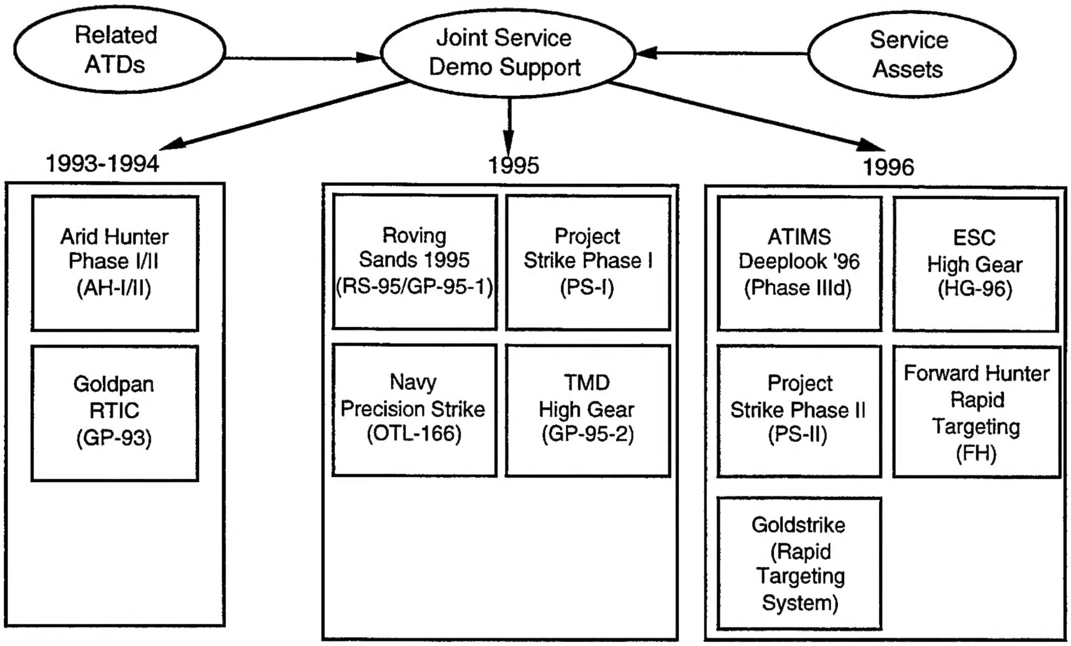

Fig 6. Capability Demonstrations.

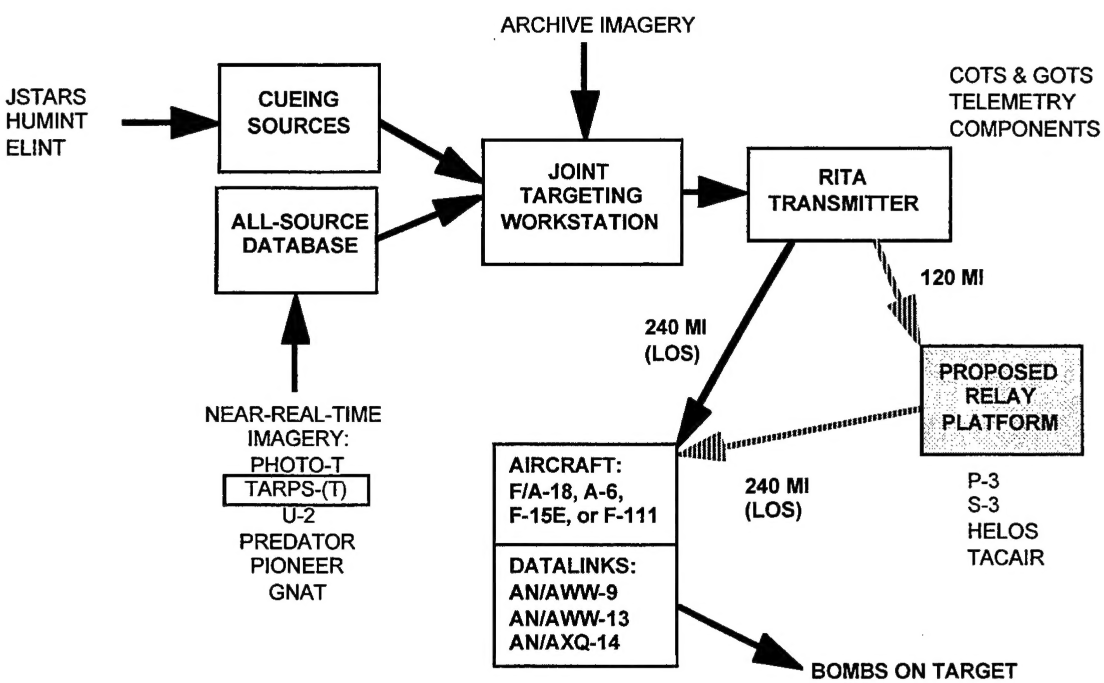

Fig 7. Arid Hunter Data Flow.

standard preflight brief supplemented by accurate GPS coordinates (300 feet).

In Arid Hunter I—against a camouflaged Scud transporter/erector/launcher (TEL) array with nine support vehicles and a decoy—85% of the aircraft without imagery were unable to find the target, and only 15% found anything else in the array (usually the decoy). No one in this group found the actual TEL. With imagery, the results were dramatically better; 73% found the TEL and another 18% found another vehicle in the array. Only 9% failed to find any target (Fig 8). Target-acquisition time, although not measured as part of the test, was significantly less for the group with imagery.

Arid Hunter II took a closer look at the effect of imagery on target-acquisition time. A scenario was used in which the Scud TEL—uncamouflaged and with no support vehicles or decoy—moved daily among 16 locations within an 800-square-mile killbox. Participating aircraft were divided into three groups: (1) killbox coordinates only, (2) GPS coordinates of the target, and (3) GPS coordinates and

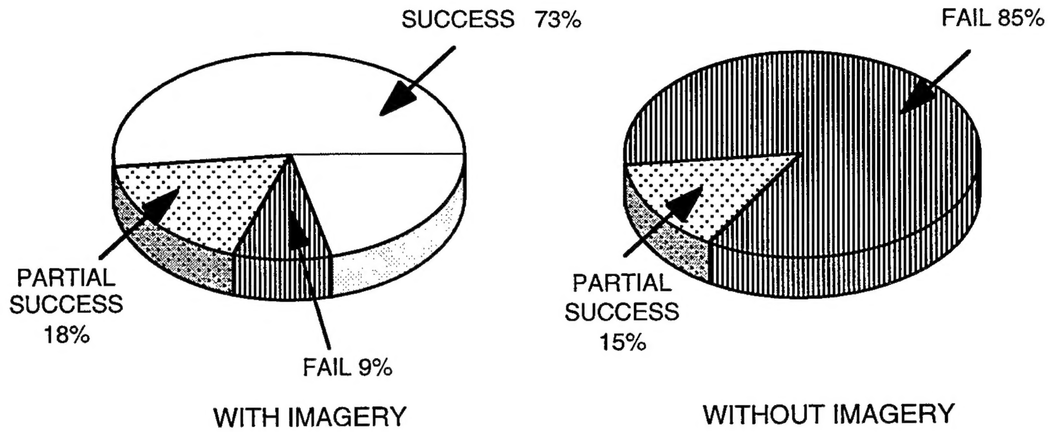

Fig 8. TBM Acquisition Results.

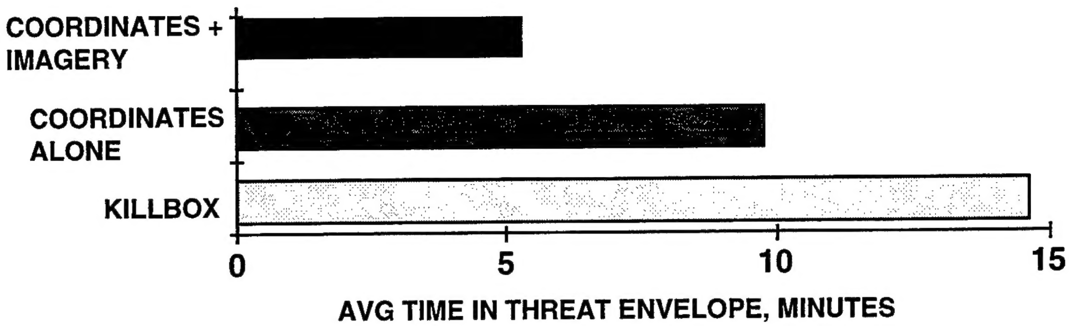

Fig 9. Target-Acquistion Time.

imagery via the data-link pods. In poor weather the average time to find the target was approximately 14 minutes for those aircraft searching the killbox, more than 9 minutes for those with GPS coordinates, and just over 5 minutes for those with GPS coordinates with imagery (Fig 9).

Arid Hunter was similar in design and results to Air Force Project Goldpan '93. From this exercise, the Air Force developed a Mission Need Statement (MNS) for RTIC. The Naval Strike Warfare Center modified this MNS slightly and submitted it for approval. The synergism between the Air Force and Navy RTIC technology communities led the Air Force to choose the NAWCWPNS ground station as the exploitation and transmit elements for Goldpan '95-I at Roving Sands and Goldpan '95-II (High Gear).

Examples of other related proof-of-concept demonstrations that have incorporated the RTIC/OT technologies include the following.

•**Roving Sands '95.** A Joint Chiefs of Staff-sponsored exercise held in May 1995 at White Sands Missile Range, N. Mex. This demonstration included MISST ground station connected to national archive and real-time ASARS and SIGINT collection systems, as well as local Command and Reporting Centers (CRCs) to support generation of RTIC products. F/A-18 and F-15E strike aircraft simulated prosecution of time-critical TBMs (i.e., Scuds). This demonstration also included generation of offboard mission replanning products (e.g., new route and weapon-launch data) sent to the ATIMS flight simulation laboratory using Link-16 protocols over a long-haul DBS link.

•**Deeplook.** A collaborative Utah Air National Guard and NAVAIR ATIMS-sponsored exercise held in June 1995 at Dugway Proving Grounds, Utah. This demonstration included Navy-developed Tactical Aircraft Mission Planning System (TAMPS) ground station equipment tied to an Apache helicopter equipped with tactical data links and real-time situation display. As part of Deeplook '96, this effort is being expanded to include multiple Apache and ground armor vehicles, satellite communications, and MISST-based offboard precision targeting equipment.

•**Project Strike Phase I.** An Air Force ACC/DR and TENCAP (SWC/DOZ)-led demonstration conducted in August 1995 involving B-1B and F-15E strike aircraft in deep-strike precision-attack mission scenarios at the Utah Test and Training Range. Testbed assets were equipped with onboard threat situation displays and image processing equipment to receive offboard imagery-derived RTIC products sent via JTIDS and UHF SATCOM digital data links. The RTIC products were generated by MISST-based targeting and mission planning systems hosted within a simulated AOC at the Hurlburt AFB Battle Staff Training School.

•**OTL #166.** A Navy-sponsored demonstration performed in conjunction with the 1995 Tomahawk Operational Test Launch #166 and JWID '95 to evaluate enhanced collaborative planning and rapid-targeting technologies. During this exercise, the MISST ground station supported pursuit of time-critical fixed targets in simulated engagements at Fallon NAS, including transfer of Pioneeer UAV targeting information to the cockpit to augment national imagery-based targeting.

•TMD-HG (Goldpan '95-II). An Air Force ESC/ZJ-led theater missile defense High Gear demonstration conducted in November 1995 at White Sands Missile Range. High Gear examined the timeline and accuracy requirements necessary to prosecute TBM launchers. This test involved F-15E aircraft equipped with GBU-15 video and JTIDS communications cued from a ruggedized MISST ground station. The ground station was tightly integrated with airborne launch detection and ASARS surveillance sensor platforms to provide RTT cueing and theater imagery, resulting in extremely short time lines from launch detection to target destruction.

•Project Goldstrike. EUCOM requested deployment of the ruggedized MISST ground station and other Goldpan elements to support potential strike operations in the Bosnian theater. The sysem supports F/A-18, F-15E, and A-6 strike aircraft with RTIC products derived from ASARS, UAV, and national imagery. The 5th Allied Tactical Air Force (ATAF) plans include moving the transmitter for better coverage and the addition of RTIC capabilities for the F-16.

RTIC/OT NEAR-TERM GOALS

It is critical at this time to build upon the successes of the past 2 years to establish a near-term operational capability, develop CONOPS, and establish figures of merit in the areas of

•Mission effectiveness	Responsiveness, accuracy, lethality, collateral damage
•Enhanced survivability	Situation awareness, threat avoidance
•Operational flexibility	Retargeting, reallocation, rules of engagement, tactics
•Operational suitability	Operator workload, resources loading, weather restrictions

The lack of these items is a major stumbling block to transition (Fig 10). As a means of addressing these issues, we began the development of an STS infrastructure that, with synergistic programs, will evolve into a production capability at NAWCWPNS to provide custom intelligence products in direct support of operational forces.

The key pieces being put in place in FY96 are several wideband secure communications links to key intelligence agencies; 500-gigabyte imagery servers and exploitation systems at China Lake and Point Mugu sites; and high-bandwidth communications to a customized rapid-targeting cell at the Naval Surface Warfare Center, Fallon. This optimized cell will be made available to the joint services for end-to-end integration and testing of offboard targeting prototypes.

Over the next few years, we plan to provide direct Global Broadcasting System (GBS) uplink capability for connectivity to attack aircraft carriers (CVAs) and amphibious assault ships (LHAs), while we work out the operational and architectural issues using the RTIC cell at Fallon. This aggressive buildup is targeted at our primary objective of facilitating the transition of RTIC/OT technologies, as well as satisfying our near-term goals of developing CONOPS and figures of merit. The cell at Fallon will be used to evaluate the CONOPS against the figures of merit and produce accepted guidance for Fleet units (Fig 11).

The full capabilities of the RTIC/OT concept, as spelled out in the Navy and Air Force MNSs, cannot be achieved by any currently developed system. The final configuration will be a "system of systems," encompassing national and theater intelligence systems, a variety of exploitation systems, and several communication links (Fig 11). For strike aircraft, the most limiting factor has been in the RTIC data link. Current data links used for command and control are not available in sufficient quantities and have insufficient bandwidth to transmit RTIC data in a reasonable amount of time. These wideband digital non-line-of-sight capabilities will not be realized until advanced communications systems are available in large quantities during the 2004 to 2010 time frame. The addition of new or modified data-link transceivers to the F/A-18 or other current tactical aircraft is clearly cost-prohibitive for demonstration or gap-filler purposes.

However, an interim solution is to use transmitters compatible with existing weapon data-link terminals, such as the AN/AWW-9, AN/AWW-13, and AN/AXQ-14.

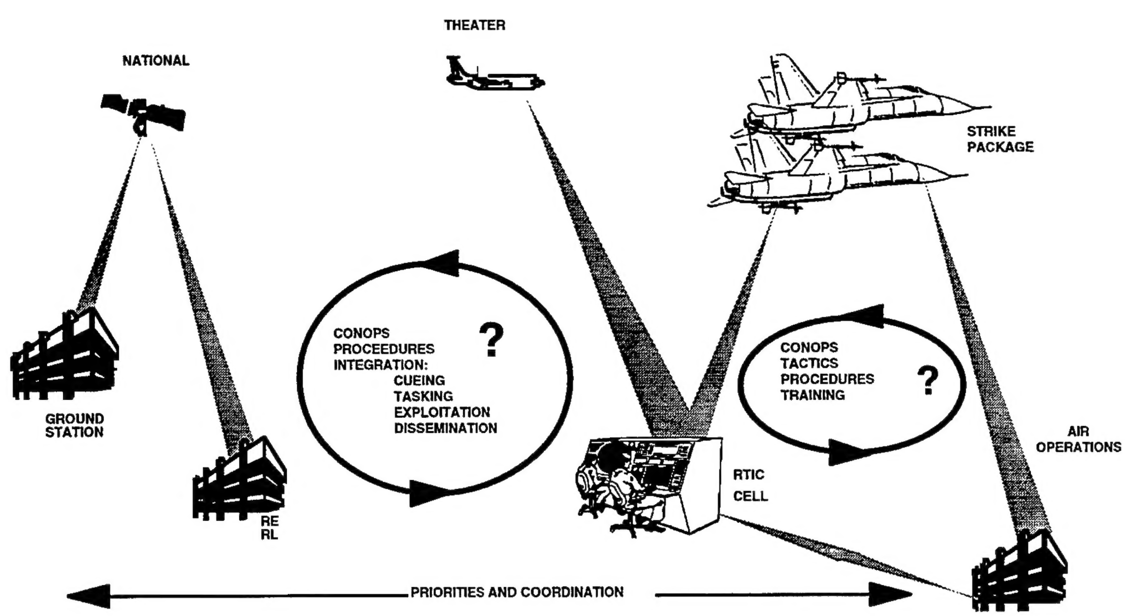

Fig 10. Transition Gap.

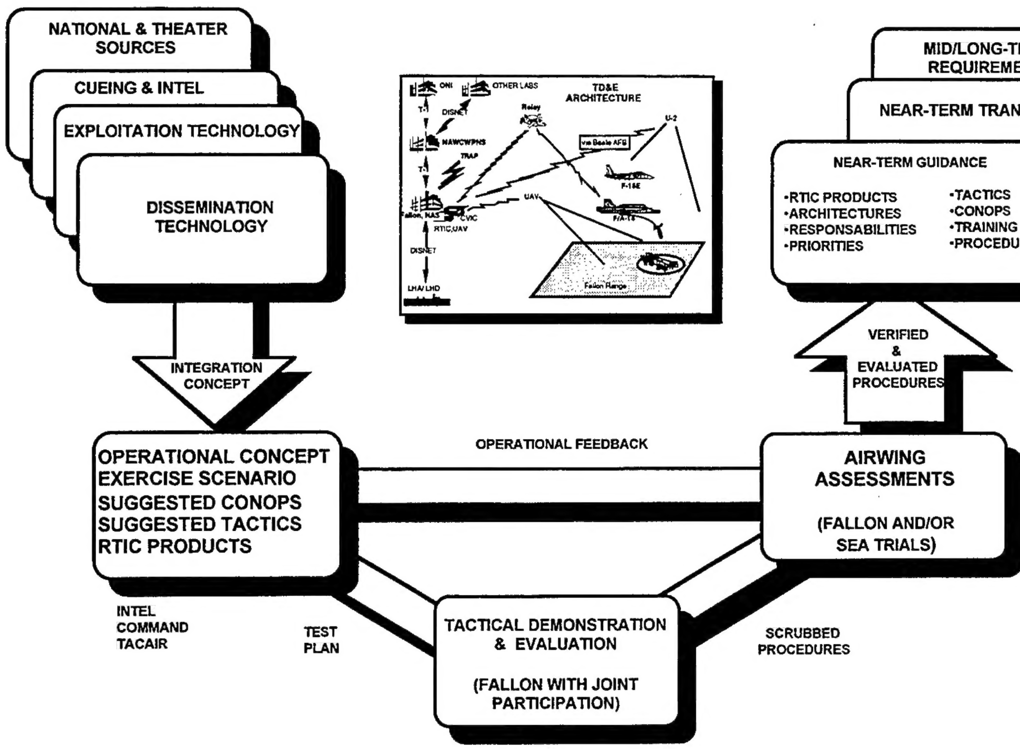

Fig 11. RTIC Cell Operations.

These terminals provide a quick, simple, wide-bandwidth pipeline to the aircraft with Navy/Air Force interoperability, and leverage the 200-million-dollar investment made in these systems over the past 20 years. The Navy and Air Force have about 350 data-link pods for the A-6, F/A-18, and F-15E.

CONCLUSION

Evolving RTIC/OT technology offers great promise in terms of survivability, lethality, and rapid response. Time and again, the Navy and Air Force, along with several other agencies, have demonstrated the value of RTIC/OT and the technical feasibility of several different approaches. The lack of integration and coordination across all the system elements is a serious issue, as is the lack of CONOPS and tactics. Considerable attention needs to be focused in these areas if this technology is to transition in the near future.

Development and deployment of a near-term RTIC/OT system now will provide a considerable experience base for integration with more advanced systems, such as JTIDS/Link-16, when they become widely available. Navy and Air Force users consistently request a relay and storage capability, and these extensions would greatly enhance the value of the current system by easing some of the geometry constraints associated with using the podded receivers and provide a future system development surrogate. Considerable investments have been made to bring RTIC/OT to the strike community. This transition is not complete, but we can see the light at the end of the tunnel.

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